7 WASTE MANAGEMENT

The purpose of this analysis is to evaluate whether the impacts of currently projected waste management practices and waste generation levels at LLNL are bounded by the analysis presented in the 1992 EIS/EIR (DOE 1992). Data on actual waste generation from current (1995–1997) routine and nonroutine (e.g., demolition, decontamination, restoration) operations and projections for anticipated future (i.e., 1998–2002) operations are compared with projections in the 1992 EIS/EIR for the year 2002.[4] Changes in waste generation rates (annual totals) and waste management practices (storage, treatment, and disposal) are compared by waste type.

Waste Management

- 1992 EIS/EIR: Waste management impacts were assessed on the basis of a projected 9% increase in waste generation rates over a 10-year period and planned improvements in waste management practices.
- 1992–1997: Through implementation of the LLNL waste minimization program, the generation of low-level waste (LLW) and hazardous waste (HW) was reduced by approximately 10% and 20%, respectively. The low-level mixed waste (LLMW) and transuranic (TRU) waste certification programs were initiated.
- 1998–2002: With the completion of the DWTF in the year 2000, continuation of the waste minimization program, and implementation of the LLW, LLMW, and TRU waste certification programs, impacts from waste management in 2002 are expected to be below impact levels projected in the 1992 EIS/EIR. With the implementation of these and other waste management programs, current projections indicate a reduction of more than 20% in waste generation compared with 1992 levels. Supplementation of the 1992 EIS/EIR for waste management and generation is not needed.

Actual waste generation data from the current routine and nonroutine operations were obtained from the LLNL Total Waste Management System (TWMS) database (Maloy 1998a). Current waste projections for the period 1998–2002 were obtained by the Hazardous Waste Management Division from individual LLNL directorate facility managers (Maloy 1998b). Information on current and projected changes in waste management practices were acquired from various EAs, recent LLNL annual environmental monitoring reports (e.g., LLNL 1997d), the *Environmental Impact Report Addendum for the Continued Operation of LLNL* (UC 1997), the *Pollution Prevention Plan* (LLNL 1997e), and the

[4] Other than a cleanup action in 1997 (see Section 7.2.2), this SA is not specific to waste that may be generated by future planned or unplanned restoration activities that may be covered under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As noted in the 1992 EIS/EIR, appropriate environmental documentation for future environmental restoration activities at the LLNL Site 300 would be prepared as a part of the Site 300 CERCLA Remedial Investigation and Feasibility Study (RI/FS) process. Any future environmental restoration activities at the LLNL site not explicitly covered in the 1992 EIS/EIR would be covered by the CERCLA RI/FS process and CERCLA Record of Decision for the LLNL site.

1992 EIS/EIR (DOE 1992). This information was used to evaluate relative changes (compared with the 1992 EIS/EIR analysis) in potential impacts to workers and members of the public from actual and projected changes in waste management activities at LLNL.

7.1 THE 1992 EIS/EIR ASSESSMENT

The 1992 EIS/EIR described the waste management program in effect in 1992 and provided a list of anticipated changes in management activities involving waste treatment, storage, and disposal during the period from 1992 through 2002. Chapter 5 of the EIS/EIR provided waste generation estimates in 1992 for low-level radioactive waste (LLW), low-level mixed waste (LLMW), hazardous waste (HW), transuranic (TRU) waste, and sanitary wastes. For the year 2002, the document projected a conservative increase of about 9% in the volume of each waste type over the baseline projection for 1992. This projected increase was based on the premise that the total square footage of LLNL facilities would increase by approximately 9% during the 10-year period. The projected 1992 and 2002 waste quantities from the 1992 EIS/EIR are listed in Table 7.1.

Various planned improvements for waste management operations at LLNL were identified in Appendix B of the 1992 EIS/EIR. These improvements were targeted at reducing waste generation and improving waste storage, treatment, and/or disposal. Planned enhancements in waste management practices included the implementation of a sitewide waste minimization plan, the completion and approval of the LLNL waste certification plan, and the completion and approval of waste acceptance criteria documents for all LLNL-generated wastes. Facility-specific actions included plans for expansion of waste processing operations in the Building 514 area to include additional equipment for hazardous waste treatment and the use of a compactor/ bailer in Building 612 for volume reduction of compactible LLW. In addition, a high-explosive open burn/open detonation facility was proposed for development near Building 845 at Site 300 to manage wastes from high-explosives operations.

TABLE 7.1 LLNL Main Site and Site 300 Waste Generation Estimates for 1992 and 2002 from the 1992 EIS/EIR

Waste Type[a]	1992	2002
Hazardous		
Liquid (gal)	350,000	381,700
Solid (lb)	604,000	658,000
Low-level		
Liquid (gal)	22,000	24,000
Solid (lb)	587,000	640,000
Low-level mixed		
Liquid (gal)	23,000	25,100
Solid (lb)	47,000	51,230
Transuranic		
Solid (ft^3)	2,700	2,940
Medical (lb)	2,612	2,843

[a] The 1992 EIS/EIR made no distinction between routine and nonroutine waste quantities.

The 1992 EIS/EIR analysis concluded that, with one exception, waste management activities during the period 1992–2002 would not result in significant environmental impacts. The one impact classified as potentially significant and unavoidable was on-site storage of LLMW beyond storage limits established under the Resource Conservation and Recovery Act (RCRA). The four mitigation measures identified to reduce impacts associated with extended LLMW storage were as follows:

1. As available and appropriate pursue alternatives or options for treatment, storage, and/or disposal;

2. Continue efforts to enhance LLNL's waste minimization policies and practices to reduce generation;

3. New or additional quantities of liquid LLMW would be treated at the wastewater treatment tank farm to reduce total volumes; and

4. If future waste generation exceeds LLNL storage capacity, LLNL would apply for additional permitted capacity until additional treatment, storage, and disposal options became available.

7.2 CHANGES FROM 1992 TO 1997

Changes over the period 1992 to 1997 in projected waste management activities covered in the 1992 EIS/EIR are discussed in Section 7.2.1; changes in waste generation are discussed in Section 7.2.2.

7.2.1 Waste Management

LLNL has instituted several changes in managing wastes and reducing routine waste generation since 1992. The *Environmental Impact Report Addendum for the Continued Operation of Lawrence Livermore National Laboratory* (UC 1997) provides an overview of programmatic changes implemented since 1992. One of the major efforts has been to enhance the characterization of wastes to include requirements of off-site treatment and disposal facilities' acceptance criteria. This effort reduces on-site storage times because wastes meet the acceptance criteria of disposal sites destined to receive them, and, therefore, scheduled shipments can proceed in an efficient manner. The following is a list of the most important changes in waste management program activities since 1992:

- An LLW certification program was implemented in 1993. As of 1997, nearly all LLW held at LLNL was fully certified to meet new waste acceptance

criteria at the Nevada Test Site (NTS). Shipments to NTS were resumed in 1993.

- A site treatment plan for LLMW was developed and implemented to comply with the 1992 Federal Facility Compliance Act. The act allowed federal facilities relief from waste storage limitations. After gaining approval from the State of California, LLNL has begun certification and is currently shipping LLMW to Envirocare in Utah for treatment and disposal.

- The LLNL TRU waste certification program was implemented to ensure that TRU wastes generated and packaged by LLNL can be certified for acceptance at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. TRU waste continues to be stored at LLNL until WIPP opens or another disposal option is identified by DOE.

- The LLNL waste minimization program was implemented in 1993 and has reduced routine waste generation volumes for all waste types except sanitary. The program is described in detail in the LLNL *Pollution Prevention Plan* (LLNL 1997e).

Other changes that will improve the efficiency of waste handling and treatment include the following: (1) issuance of a RCRA Part B permit (approval pending) to allow construction of the permitted portions of the DWTF (e.g., Building 695, Building 280, Building 693 annex), which includes use of new technologies for treating hazardous and mixed wastes; and (2) construction of the non-RCRA permitted portions of the DWTF complex (e.g., Building 696, Building 697) to provide additional storage and treatment options for radioactive-only wastes. The DWTF, when fully operational (anticipated to be November 2000), will consolidate LLW, LLMW, and HW management operations from dispersed management facilities that currently treat, store, and prepare wastes for off-site shipment. The consolidation of operations will involve both new and existing buildings at LLNL (DOE 1996a). The DWTF will also add capability to treat a greater variety of LLW and LLMW wastes.

Wastes generated at Site 300 will continue to be managed as described in the 1992 EIS/EIR except that wastes previously disposed of at the Tracy Landfill will be disposed of at the Altamont Landfill in Alameda County. This change took place in 1994 when the Tracy Landfill closed. More importantly, facility and operational changes have occurred or are planned that would lower waste generation rates.

7.2.2 Waste Generation

Information from the TWMS database was analyzed to determine the current actual levels of waste generation at LLNL (Maloy 1998a). The actual quantities of routine and nonroutine waste generated in each of the three calendar years (1995–1997) for which data are available are summarized in Table 7.2. The data show nonroutine waste generation varied from about 40% to about 80% of the total waste generated during this period. Quantities of all the routinely generated waste, with the exception of LLMW, showed sharp declines. Although there was considerable variation in nonroutine LLW and HW generation, routine LLW and HW quantities showed steady declines of over 50% from 1995 to 1997. All of the TRU waste generation, which declined about 25% in this period, was from routine operations.

Scheduled demolition, decontamination, and decommissioning of facilities and an unscheduled emergency removal action in 1997 contributed to the increase in nonroutine waste generation from 1995 to 1997. In 1995, the Building 435 cooling towers were dismantled, and contaminated soil was removed from Building 404; these actions contributed to increases in both LLW and LLMW (LLNL 1996). Nonroutine operations from housekeeping and solid LLW from contaminated gravel produced by explosive tests with conventional ordnance at the Site 300 firing tables in 1994 were major contributors to the one-time HW and LLW quantities generated in 1995. More than 75% of the nonroutine hazardous waste generated in 1997 (1,785,060 lb) came from two cleanup activities. One of these activities was a Comprehensive Environmental Response, Compensation, and Liability Act/Toxic Substances Control Act (CERCLA/TSCA) removal action involving about 770 tons of polychlorinated biphenyl (PCB)-contaminated soil and capacitors uncovered during excavation at the NIF construction site. The capacitors and contaminated soil were expeditiously removed and disposed of in accordance with all applicable regulations (LLNL 1998). The other cleanup activity, replacing a roof on Building 152, generated approximately 120 tons of HW.

In conjunction with the NIF excavation, a Supplemental EIS (SEIS) is being prepared for the NIF portion of the Stockpile Stewardship and Management Programmatic EIS. This action is being taken pursuant to an agreement specified in the Joint Stipulation and Order approved and entered as an order of the court on October 27, 1997, in partial settlement of the lawsuit NRDC v. Pena, Civ. No. 970936 (SS) (D.D.C). This agreement included commitment to and completion of a thorough historical record search (along with worker interviews) relative to potential contamination in seven areas surrounding or adjacent to the NIF site. Commitment was also made to conduct geophysical surveys, soil borings and/or soil vapor surveys, and groundwater monitoring, as appropriate. The Notice of Intent for the preparation of the SEIS was published on September 25, 1998.

TABLE 7.2 Actual Waste Generation Quantities by Waste Type at LLNL for 1995 through 1997

Waste Type	Quantities Generated (lb)[a] Routine	Nonroutine	Total	Nonroutine Portion (%)
Calendar Year 1995				
LLMW	118,841	168,740	287,582	59
HW	1,094,784	913,142	2,007,926	45
LLW	436,801	79,948	516,748	15
TRU	2,997	0	2,997	0
All types	1,653,423	1,161,830	2,815,253	41
Calendar Year 1996				
LLMW	247,341	124,202	371,542	33
HW	737,298	882,028	1,619,326	54
LLW	323,446	373,836	697,282	54
TRU	2,517	0	2,517	0
All types	1,310,601	1,380,066	2,690,667	51
Calendar Year 1997				
LLMW	81,547	161,619	243,166	66
HW	471,331	2,298,306	2,769,636	83
LLW	163,441	547,935	711,377	77
TRU	2,256	0	2,256	0
All types	718,575	3,007,860	3,726,435	81

[a] The original waste quantity units (gal, lb, ft^3) used in the TWMS database are the standard units in which the data are provided on the Waste Disposal Requisitions. Unit conversion factors used in the numbers reported here are as follows: 8.34 lb/gal, 2,205 lb/m^3, 35.3 ft^3/m^3 (Maloy 1998a).

7.3 ANALYSIS OF PROJECTED CHANGES FROM 1998 TO 2002

The 1992 EIS/EIR summarized waste impacts for the year 2002 from projected changes in waste management practices and waste generation. Changes in projected waste management activities covered in the 1992 EIS/EIR are discussed in Section 7.3.1, and changes in waste generation are discussed in Section 7.3.2. Overall, the enhancements in waste management operations highlighted below and the reductions in waste generation and/or storage planned at LLNL for the next 5 years and beyond should reduce potential environmental impacts below those projected in the 1992 EIS/EIR for the year 2002.

7.3.1 Waste Management

Several changes have occurred in waste management practices during the past 5 years that will reduce impacts in the future. Beneficial changes have occurred that reduce the need for increased shipments of materials to and from the LLNL main site and Site 300. The operations of the Chemical Exchange Warehouse will allow LLNL to efficiently identify excess chemicals from ongoing or discontinued programs and make them available for new programs (Quong 1998), thus reducing incoming shipments of chemicals. Use of a gravel washer at Site 300 to recondition used gravel from the firing tables had recovered over 87% of the gravel for reuse by 1995, thus reducing the need for waste treatment and shipment. Other beneficial actions that will reduce potential impacts of waste management activities before 2002 include (1) upgrading or closure of wastewater retention tanks (for nonhazardous, hazardous, LLMW, and LLW categories of waste) to reduce the potential for radionuclide releases to the sewer system, (2) operation of the DWTF in about 2 years (November 2000) to allow use of new treatment technologies and provide for minor increased waste storage, primarily for radioactive-only wastes, (3) continuation of the pollution prevention program, and (4) enactment of the certification program for TRU waste and the continuation of certification and off-site shipments of LLMW and LLW to ensure that wastes are properly characterized and will meet acceptance criteria at disposal sites.

Enhanced characterization of LLW, LLMW, and TRU wastes to meet off-site facility waste acceptance criteria will permit waste acceptance by commercial and federal facilities for disposal. The overall effect of these changes in waste management operations at LLNL will be to reduce on-site legacy waste inventories and storage times. Characterization under the legacy waste program provides information on the process or the research experiment that generated the waste and on the chemical, physical, and radiological characteristics of the waste (Quong 1998). This initial information is used to determine the most likely disposal site. The disposal site's waste acceptance criteria define any additional parameter requirements. Waste certification and other waste management practices planned over the next 5 years will reduce potential environmental, health, and safety impacts at and around the LLNL site and improve the overall Laboratory operation efficiency.

TABLE 7.3 LLNL Waste Generation Comparison: 1992 Baseline and 1992

EIS/EIR Projections for 1997 and 2002 versus 1997 Actual and Current Projections for 2002

	Waste Generation (lb)[a]				
	1992	1997		2002	
Waste Type	EIS/EIR Baseline[b]	EIS/EIR Projection[c]	Actual	EIS/EIR Projection[d]	Current Projection[e]
HW	3,523,000	3,681,500	2,769,600	3,841,400	2,833,200
LLW	770,400	805,100	711,400	840,200	584,700
LLMW	238,000	248,700	243,200	261,100	199,300
TRU	168,700	176,200	2,300	183,600	43,800

[a] All data are in pounds rounded to the nearest 100 lb. Waste volumes expressed in gallons (liquids) and cubic feet (solids) were converted to pounds by assuming specific weights of 8.34 lb/gal for liquid waste and 2,205 lb/m^3 for solid waste, and the following conversion factor: 1 m^3 = 35.3 ft^3.

[b] Quantities are based on data presented in the 1992 EIS/EIR.

[c] Projections are based on a 4.5% increase over generation levels in 1992 for each waste type.

[d] Estimates for 2002 presented in the 1992 EIS/EIR assumed an increase of approximately 9% for each waste type over the 10-year period.

[e] Projections are based on the best currently available LLNL data (Maloy 1998a-b) and the assumption that nonroutine waste generation in 2002 would be at about current levels (nonroutine estimates based on average of 3 years of actual data from waste generation rates in 1995 through 1997 [Maloy 1998a]). These estimates are conservative because of the atypical nonroutine waste generation in 1997 caused by the excavation of capacitors and contaminated soil at the NIF site. See Section 7.2.2 for further discussion of the removal action. The TRU waste projections for the year 2002 are based on the assumption of funding for the proposed MOX project.

7.3.2 Waste Generation

Current projections for both routine and nonroutine waste generation between 1998 and 2002 (existing programs and anticipated new programs) were obtained from LLNL facility managers (Maloy 1998b) for comparison with projections made in the 1992 EIS/EIR for the year 2002. The two sets of projections are included in Table 7.3. The 2002 waste generation quantities, based on projections from 1992 EIS/EIR estimates and current data, enable a comparison with current actual 1997 and 1992 EIS/EIR baseline data.

New LLNL facilities that will become operational before the year 2002 and other activities generating wastes during that period include research and development for the Uranium Atomic Vapor Laser Isotope Separation process (i.e., U-AVLIS Pilot Operations during 1999-2000), the NIF in support of the DOE Stockpile Stewardship and Management Program, and decommissioning and decontamination of various buildings. These facilities will produce LLW, LLMW, TRU waste, and HW, but the quantities of wastes from these activities and other routine LLNL operations in the year 2002 are not expected to exceed the quantities projected for 2002 in the 1992 EIS/EIR. The *Environmental Impact Report Addendum for Continued Operation of Lawrence Livermore National Laboratory* (UC 1997) describes the implications of these facilities on future waste generation levels and impacts during the next 5 years. The overall effect of these changes would be to reduce routine waste generation, although some of these changes may result in one-time increases in nonroutine waste generation.

Operations to manage future waste generation at LLNL are expected to be more than adequate to process the types and quantities of wastes anticipated. An evaluation of the database of estimated waste generation during the next 5 years (Maloy 1998b) suggests that data obtained from LLNL facility managers predominantly represent routine wastes (more than 95% of the total). Further examination of current actual waste generation data (1995 through 1997) suggests that routine wastes are typically less than 50% of the total waste. Although it is not possible to project unanticipated nonroutine waste generation quantities from unknown burial sites, a conservative assumption would be that the total quantities of nonroutine waste (including unplanned waste) generated in 2002 would remain at about the current levels. Even with this assumption, the total projected waste generation for the year 2002 (Table 7.2) is well within the 9% increase predicted in the 1992 EIS/EIR for the period of 1992–2002. In fact, these current projections are lower than the 1992 baseline generation quantities presented in the 1992 EIS/IER.

7.4 CONCLUSIONS

The review of current and projected LLNL waste management practices through the year 2002 indicates a shift from on-site storage of LLW, TRU, and LLMW to off-site treatment, storage, and disposal. This shift and a projected reduction in waste generation by the year 2002 (from that projected in the 1992 EIS/EIR) are expected to reduce the associated potential safety and health hazards to LLNL workers handling this waste and to off-site populations. Projected changes in hazardous waste management practices are expected to reduce the waste retention time at on-site 90-day storage facilities, which will reduce the multiple handling of waste containers and consequently the potential safety and health hazards. With completion of the DWTF in the year 2000, implementation of the LLW and TRU certification programs, and continuation of the waste minimization program at LLNL, impacts from waste management operations are expected to be below the levels projected for the year 2002 in the 1992 EIS/EIR. This assessment is supported by improved routine waste generation projections from recent actual data and incorporates the assumption that nonroutine waste generation will be at about the current levels in the year 2002. In fact, with this assumption, the waste generation at LLNL in the year 2002 is expected to be about 20% lower than the EIS/EIR 1992 baseline levels for LLW,

LLMW, and HW, and about 75% lower for TRU waste. These considerations and analyses support the conclusion that the 1992 EIS/EIR adequately bounds the impacts from waste management activities through the year 2002, and, thus, no supplementation of the 1992 EIS/EIR for waste management and generation is necessary.